

### **REMARKS**

Reconsideration and allowance of the above-identified application are respectfully requested. Upon entry of this Amendment, claims 1-6, 8-23, 25-29, 31 and 32 will remain pending.

Claims 1-15, 22, 23 and 25-27 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. In addition, claims 16 and 28 are rejected under 35 U.S.C. § 102(e) as being anticipated by published U.S. Patent Application Number 2005/0029450 to Hough et al. Also, claims 24-26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hough. Furthermore, claims 1, 4-9, 13, 14, 29 and 30 are rejected under 35 U.S.C. § 103(a) as being unpatentable over published U.S. Patent Number 2002/0179833 to Shirakawabe et al. in view of either Hough or U.S. Patent Number 6,886,395 to Minne. In addition, claims 16-18 are rejected under 35 U.S.C. § 102(b) as being anticipated by Shirakawabe, and claims 19, 24 and 25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shirakawabe. Furthermore, claims 1, 4-6, 14-16, 18, 21, 28 and 29 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Number 6,185,991 to Hong et al., and claims 7, 8, 13, 19, 24-26, 30 and 31 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hong. Finally, claims 9-12 and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hong in further view of U.S. Patent Number 6,330,824 to Erie. Applicants respectfully submit that the claims should be allowable over these references for the reasons discussed below.

The embodiments of the present invention will now be discussed, and the rejections will be individually addressed below.

To begin, Applicants will address the issues pertaining to the forces  $F_{\text{direct}}$  and  $kx$  raised by the Examiner on page 7 of the Office Action.

As described throughout the present application, the embodiments of the present invention provide a probe for use in an atomic force microscope or for nanolithography. The probe comprises a force sensing member connected to a probe tip. A typical cantilever probe is described on page 4, line 28 through page 5, line 17 of the present application. When the tip of the cantilever probe is pressed against a sample surface, the cantilever beam is bent upwards as shown in Figure 1 of the present application. The bent beam will therefore experience a straightening (restoring) force that, at the tip, is a downward force which (assuming that Hooke's Law applies) is equal to  $kx$ . As the sample surface is scanned, the degree of bending changes as the height of the sample varies and/or as the interaction between the sample and probe tip varies. Thus, the magnitude of the force  $kx$  acting on the cantilever tip varies during the scan.

As described throughout the present application, the embodiments of the present invention introduced an additional force ( $F_{\text{direct}}$ ) that is applied to the cantilever tip. This force can be generated through a variety of mechanisms, such as a magnetic, electrostatic or capillary mechanism. A magnetic force, for example, can be generated by including a magnetic lead on the cantilever tip and applying a magnetic field to the cantilever/sample arrangement as shown in Figure 3 and described, for example, on page 5, lines 27-28 of the present application. (e.g., "A probe in accordance with the present invention is adept in such that, as the sample is scanned, experiences a biasing force that is considerably larger than the restoring force  $kx$ "). The biasing force is denoted, for example, by  $F_{\text{direct}}$  in Figure 8.

On page 7 of the Office Action, the Examiner states that “possibly the  $F_{\text{direct}}$  force is improperly defined (as in “ $F_{\text{direct}}$  acting to accelerate the probe toward the sample”), and  $F_{\text{direct}}$  is really the force applied between the sample and the tip that is in addition to the force (i.e.,  $kx$ ) created by the cantilever bending.” Applicants respectfully submit, however, that the Examiner is misconstruing the origin of the force  $F_{\text{direct}}$  with the affect that it has on the cantilever. That is, although the force  $F_{\text{direct}}$  is the force applied between the sample and tip as appreciated by the Examiner, the affect that this force has is to accelerate the probe toward the sample as shown in Figure 8 of the present application. Also, the discussion on page 20 of the present application referred to by the Examiner describes what occurs if the probe is deflected away from the surface of the sample. That is, if the bending is increased, the force  $F_{\text{direct}}$  acts to accelerate the probe back toward the sample. If the probe and sample are in contact then there will be no actual movement, but the force  $F_{\text{direct}}$  which urges the probe and sample together still exists. If the probe tip is deflected upwards, then the probe bending will increase, and the force  $F_{\text{direct}}$  then acts to accelerate the probe back toward the surface by straightening the cantilever. That is, the force  $F_{\text{direct}}$  and  $kx$  (whose origin is the cantilever bend) are two separate and distinct forces that are applied to the same point, which is the tip of the cantilever. In applying these forces to the cantilever they may act cooperatively or in opposition depending on the circumstances.

Again, the origin of the force  $kx$  is due to the bending of the cantilever, and the origin of the force  $F_{\text{direct}}$  is the interaction of the probe with some external influence, such as a magnetic, electrostatic or capillary force. The force  $F_{\text{direct}}$  will urge the tip back into contact with the sample and also counteract bending of the probe, while the force  $kx$  will act on the probe in a manner dependent with the magnitude of the bend.

The 35 U.S.C. § 112, Second Paragraph, Rejection

As indicated above, independent claim 6 is being amended to remove the words “or for nanolithography” and claim 1 is amended to depend from claim 6. Also, claim 6 is being amended to include the subject matter of dependent claim 7, and claim 7 is being canceled. Furthermore, independent claim 16 is being amended to include a similar limitation from dependent claim 24, and dependent claim 24 is being canceled. Also, claim 29 is being amended to include the limitations of claim 30, and claim 30 is being canceled. In addition, independent claim 32 is being amended in a manner similar to claim 16.

It is believed that the above amendments to claims 1, 6 and 26 will address the objections by the Examiner set forth in this rejection. Concerning claim 22, applicants submit that this claim was not among those identified in the listing of claims in the Remarks of the response to the election of species requirement filed on April 4, 2007. Concerning claim 25, if the Examiner believes that claim 25 is directed to the non-elected species, the Examiner can include claim 25 among the withdrawn claims. In any event, Applicants submit that claims 22 and 25 fully comply with 35 U.S.C. § 112, even if not directed to an elected species.

However, Applicants note that dependent claim 4, which was included in the listing of claims in the April 4, 2007 Response, clearly reads the embodiment showing Figure 7 and thus should be included among the examined claims. In any event, since claim 4 depends from independent claim 6 via now dependent claim 1, and claims 22 and 25 depend from independent claim 16, if independent claims 6 and 16 are found to be allowable, all claims dependent on those claims should be allowable as well.

In view of the above, the Examiner is specifically requested to withdraw this rejection.

#### The Art-Based Rejections

As will now be discussed, Applicants respectfully submit that none of the cited references teaches or suggests applying an external force to a probe comprising a force sensing member having a low quality factor as recited, for example, in independent claims 6, 16 and 32. Applicants further submit that none of the cited references teaches or suggests the feature relating to dissipating energy as recited in amended independent claim 29. As described on page 4, lines 16 and 17 of the present application, these features further improve the tracking of the surface of a sample during a scan because the additional force urges the probe toward the sample surface and maintains a more consistent contact while the low quality factor minimizes the energy that can be stored in the probe and thus minimize the time it takes for a deflective probe to be returned to the sample surface.

#### The 35 U.S.C. § 102(e) Rejection of Claims 16 and 28

In this rejection, the Examiner contends that Hough teaches the features recited in these claims. However, Applicants respectfully submit that paragraph 0052 of Hough discloses that “the magnetic particle 32 in the electromagnetic coil 34 arranged such that the magnetic field generated by the electromagnetic coil 34 when energized drives the magnetic particle 32 away from the surface of the specimen 18.” Applicants respectfully submit that this is contrary to the “force generating means” recited in independent claim 16 which urges the probe toward the sample or vice versa. Accordingly, the operation of the Hough apparatus is completely different

from that of the embodiment of the present as recited in independent claim 16. Hence, this rejection should be withdrawn.

The 35 U.S.C. § 103(a) Rejection of Claims 24-26

As indicated above, claim 24 has been canceled and claims 25 and 26 have been amended to depend from claim 16. Applicants respectfully submit that as demonstrated above, the operation of the Hough apparatus is completely unlike that of the embodiment recited in independent claim 16. Accordingly, Applicants respectfully submit that one skilled in the art would not have found the embodiment of the present invention even as recited in independent claim 16 obvious in view of the teachings of Hough. Hence, independent claim 16, and remaining dependent claims 25 and 26, should be allowable.

The 35 U.S.C. § 103(a) Rejection of Claims 1, 4-9, 13, 14, 29 and 30

In this rejection, the Examiner contends that the Shirakawabe reference describes the probe with the coating that is biased by a magnetic field which results in a greater force between the sample and the tip. However, Applicants respectfully submit that Shirakawabe failed to teach or suggest that the magnetic force is applied to the tip of the probe. Rather, the use of a magnetic coating on the cantilever is provided as an example for performing magnetic force microscopy (MFM) to render the cantilever responsive to changes in the magnetic property as described in paragraphs 0033-0034 of Shirakawabe. Accordingly, Applicants respectfully submit that Shirakawabe teaches a system completely unlike that of embodiment of the present invention as defined even in independent claims 6 and 29. In addition, as discussed above,

Applicants submit that the Hough reference fails to teach or suggest this feature but rather, teaches driving a magnetic particle 32 away from the surface of a specimen 18. The Minne reference is cited for using tips smaller than 100nm, but also does not make up for the deficiencies in the teachings of the Shirakawabe reference. Hence, this rejection should be withdrawn.

The 35 U.S.C. § 102(b) Rejection of Claims 16-18

In this rejection, the Examiner relies on the teachings of Shirakawabe. However, as discussed above, the magnetic coating on the cantilever in Shirakawabe is used for MFM, and not to urge the probe toward the sample. Hence, Applicants submit that Shirakawabe fails to anticipate the embodiment of the present invention even as recited in independent claim 16. Accordingly, this rejection should be withdrawn.

The 35 U.S.C. § 103(a) Rejection of Claims 19, 24 and 25

As indicated above, claim 24 has been canceled. Also, claims 19 and 25 depend from independent claim 16. Because Shirakawabe fails to teach or suggest an arrangement similar to the embodiment of the present invention even as recited in independent claim 16, Applicants respectfully submit that one skilled in the art would not have found it obvious to have achieved the embodiment of the present invention even as recited in independent claim 16 in view of the teachings of Shirakawabe. Hence, independent claim 16, and all dependent claims, including independent claims 19 and 25, should be allowable.

The 35 U.S.C. § 102(b) Rejection of Claims 1, 4-6, 14-16, 18, 21, 28 and 29

In this rejection, Examiner relies on the teachings of Hong in which an electrostatic field is allegedly used to supply a force that urges a probe toward a sample. However, Applicants respectfully submit that nowhere does this reference teach or suggest the quality factor of the probe as recited in independent claims 6 and 16, and its relevance to damping probe oscillation. This reference also fails to teach the features recited in independent claim 29 pertaining to, for example, the energy dissipation. Accordingly, Applicants respectfully submit that the Hong reference fails to anticipate the embodiments of the present invention even as recited in independent claims 6, 16 and 29 and thus this rejection should be withdrawn.

The 35 U.S.C. § 103(a) Rejection of Claims 7, 8, 13, 19, 24-26, 30 and 31

As discussed above, Applicants respectfully submit that Hong fails to teach or suggest the embodiments of the present invention even as recited in independent claims 6, 16 and 29. Accordingly, Applicants respectfully submit that one skilled in the art would not have found it obvious to have achieved the embodiments of the present invention even as recited in these independent claims from the different teachings of Hong. Accordingly, all claims should be allowable.

The 35 U.S.C. § 103(a) Rejection of Claims 9-11, 12 and 27

As with the above rejections based on Hong, Applicants respectfully submit that Hong fails to teach or suggest the embodiments of the present invention even as recited in independent claims 6 and 16. Erie teaches the use of coating on a cantilever in order to absorb energy to



In re Appln. of Humphris et al.  
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stimulate the deflection or vibration of the cantilever, which is unlike the coating in the claimed embodiments that is used to absorb mechanical energy to damp cantilever motion. Furthermore, the teachings of Erie fail to make up for the deficiencies in the teachings of Hong discussed above with regard to the independent claims. Hence, Applicants respectfully submit that one skilled in the art would not have found it obvious to have achieved the embodiments of the present invention even as recited in the independent claims in view of the teachings of Hong and Erie. Thus, all claims should be allowable.

In view of the above, it is believed that the subject application is in condition for allowance and notice to this effect is respectfully requested. Should the Examiner have any questions, he is invited to contact the undersigned at the number indicated below.

Respectfully submitted,

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